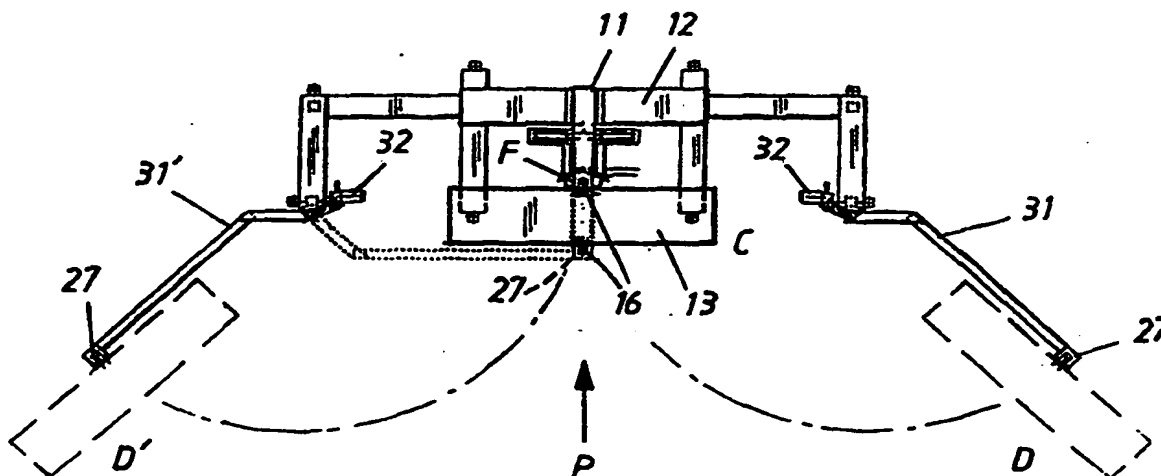


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<p>(21) International Application Number: PCT/SE98/00176</p> <p>(22) International Filing Date: 2 February 1998 (02.02.98)</p> <p>(30) Priority Data: 9700370-1 3 February 1997 (03.02.97) SE</p> <p>(71) Applicant (for all designated States except US): ASEA BROWN BOVERI AB [SE/SE]; S-721 83 Västerås (SE).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): LEIJON, Mats [SE/SE]; Hyvlargatan 5, S-723 35 Västerås (SE). BACKLUND, Alberti [SE/SE]; Orrvägen 2, S-734 37 Hallstahammar (SE). KALLDIN, Hans-Olof [SE/SE]; Grenadjärgatan 9, S-723 46 Västerås (SE). LINDBORG, Tomas [SE/SE]; Stångjärmsgatan 41, S-724 77 Västerås (SE). JOHANSSON, Kenneth [SE/SE]; Bangatan 23 B, S-722 28 Västerås (SE).</p> <p>(74) Agent: KARLSSON, Leif; L.A. Groth & Co. KB, P.O. Box 6107, S-102 32 Stockholm (SE).</p>		<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, ES, FI, FI (Utility model), GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report.</p>

(54) Title: DUAL DRUM CAPSTAN



(57) Abstract

A device for coiling and uncoiling elongated goods (K), such as wire, cable or the like, onto a drum (13) comprises a support (12) with driving means (25) for a spreader arm (10). The spreader arm (10) is rotatably mounted on the support (12) and supports a gripping arm (14) for coiling and uncoiling the elongated goods (K) onto the stationary drum (13). The gripping arm (14) is formed as a curved V-profile, which has a running track arranged for the elongated goods (K), which running track is oriented towards the drum (13). The said running track is defined by feeding rollers which are mounted within the gripping arm (14). The feeding rollers are spherical in shape and present a rolling resistance near zero to eliminate twisting of the elongated goods (K) during coiling and uncoiling. The device also comprises at least one drum swinging arm (31, 31') connected to the support (12) so as to collect or deliver the drum at the support.

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DUAL DRUM CAPSTAN**Technical field**

The present invention relates to a device for
5 coiling and uncoiling elongated goods, such as wire, cable
or the like, onto a drum and comprising a support with
driving means for a spreader arm, which is rotatably mounted
on the support for coiling and uncoiling the elongated goods
onto the stationary drum.

10

Prior art

Coiling and uncoiling of wire, cable and similar
elongated goods by means of a coiling device is per se
previously known. During coiling by means of such known
15 devices, the coiled goods are torsionally twisted, wherein
one turn of coiling produces one turn of twisting. Counter-
clockwise coiling produces clockwise twisting, and clockwise
coiling produces counter-clockwise twisting. Uncoiling
usually takes place in the opposite direction to the
20 coiling. When all the coiled goods have been uncoiled as
above there is no remaining twist, however, mechanical
stress in the goods has resulted.

Owing to frictional resistance in the spreader arm
and in the goods, twisting is not linear along the length of
25 the goods but the portion last coiled will have a con-
siderably larger amount of twist as compared to a previously
coiled portion of the goods.

The non-linearity of the twisting thus arisen
during coiling, which causes mechanical stress in the elong-
30 ated goods, is not acceptable in some situations. For
example, when mounting a cable in a stator for an electric
machine, the cable is required to be completely free or
nearly free from twist, i.e. twisting of the cable should be
linear relative to the cable length. This implies that one
35 turn of uncoiling from the drum arbitrarily along the length
of the cable should be free or nearly free from twist.

Summary of the invention

To solve the problems pointed out above, the device according to the invention has a spreader arm which, at the side thereof facing the goods, presents a gripping arm,
5 arranged to guide the elongated goods substantially in a tangential direction relative to the periphery of the drum. At least one drum swinging arm is connected to the support so as to collect or deliver the drum at the support.

In a preferred embodiment of the device according
10 to the invention, the gripping arm has a running track in the form of a curved V-profile. To advantage, the surface of the running track contacting the goods is defined by feeding rollers, which are spherical in shape and present a rolling resistance near zero to eliminate twisting of the elongated
15 goods during coiling and uncoiling.

In order to achieve a uniform layer of the elongated goods coiled onto the drum, the spreader arm preferably is provided with a device for moving the gripping arm, so that the latter runs along the width of the drum in
20 accordance with the coiling or uncoiling of the goods.

To advantage, the preferred embodiment of the device according to the invention has two drum swinging arms connected to the support, one on either side of the support. The two drum swinging arms are arranged for alternately
25 placing a coiled drum in the uncoiling position of one drum swinging arm and collecting an empty drum in the uncoiling position of the other drum swinging arm and vice versa.

The present invention further relates to a mounting machine and to an intermediate storage means respectively
30 comprising a device for coiling and uncoiling of the above-mentioned kind and intended for feeding a cable when mounting the cable in the slots of a stator for an electric machine.

The device, the mounting machine and the inter-
35 mediate storage means are special but not exclusively intended to be applied when mounting high-voltage cable, on a generator where high-voltage cable is used in the windings

of the stator, said cable lacking the outer protective covering normally surrounding such cable.

The cable is preferably of the kind consisting of an inner core with a plurality of wires, an inner semi-conductive layer surrounding the core, an insulating layer surrounding the inner semiconductive layer and an outer semiconductive layer surrounding the insulating layer, preferably with a diameter of about 20 to 200 mm and a conductor area ranging from 80 to 3000 mm².

Brief description of the drawings

A preferred embodiment of the coiling device according to the present invention will now be described in more detail with reference to the appended drawings, where

Fig. 1 is a schematic view of equipment for mounting a cable in the stator slots of a stator for an electric generator, which equipment comprises coiling devices according to the invention,

Fig. 2 is a side view illustrating the principle of the coiling device according to the invention,

Fig. 3 is a section A-A according to Fig. 2 through the gripping arm associated with the coiling device,

Fig. 4 is a top view of the preferred embodiment of the coiling device according to the invention and

Fig. 5 is a front view of the coiling device seen in the direction of the arrow P according to Fig. 4.

Description of preferred embodiments

When mounting a cable K in a stator S, for example, for an electric generator according to the copending Swedish patent application 9700364-4 entitled "Method and device for mounting cables", in an embodiment with dual drum capstan, equipment such as the one shown in Fig. 1 is used. Said equipment comprises a coiling machine 2 and a dual drum capstan 3 by means of which the cable K to be mounted in the stator S is distributed to cable feeders A and B. In the exemplified equipment the coiling machine 2 is formed in the

way evident from the copending Swedish patent application 9700366-9 entitled "Coiling device".

The principle of the dual drum capstan 3 according to the present invention is illustrated in Figs. 2 - 5. From 5 Fig. 2 may be seen that a spreader arm 10 is rotatably mounted on an axle 11 and is brought to rotate by a driving means 25, 26 provided in the support 12 of the device. The spreader arm 10 thus rotates around the centre of rotation R as indicated by the dash and dot line 10', when coiling and 10 uncoiling elongated goods K onto a stationary drum 13. The spreader arm 10 supports a gripping arm 14, which is drivably mounted along the spreader arm 10 as will be described below.

To provide coiling and uncoiling of a cable K 15 without twist, the gripping arm 14 has a V-shaped cross section within which feeding rollers 20 are mounted in holders 21, as shown in Fig. 3. The feeding rollers 20 are spherical in shape and serve as a running track for the cable K. The spherical rollers 20 have a rolling resistance 20 near zero, implying that twisting of the cable K is eliminated during coiling and uncoiling.

Since each holder 21 is mounted in a spring biased shaft 22 in the V-shaped gripping arm 14, the spherical rollers 20 are automatically adjustable for advancing cables 25 of various dimensions, which is indicated by the cable sizes K, K' and K" in Fig. 3.

As is evident from Fig. 2, the support 12 contains a driving motor 25 which via a belt or chain drive 26 brings the spreader arm 10 to rotate around the axle 11 fixedly 30 mounted in the support 12. At the end of the axle 11 facing outwardly from the support 12 there is provided a coupling means F arranged to support the drum 13.

The spreader arm 10 has a boom 28, whose under side (facing the drum 13) is formed with a screw 29 for feeding 35 the gripping arm 14. The screw 29 is driven by means of a belt 30 or chain drive connected to the fixed axle 11, the screw 29 being advanced along the boom 28 in dependence on

the rotation of the spreader arm 10. The cable K is hereby coiled and uncoiled along the periphery of the drum 13.

Figs. 4 and 5 show a preferred embodiment of the device for coiling and uncoiling according to the invention. On either front surface of the drum 13 there is a tap-formed counter-coupling device 16 for cooperation with the coupling means F (Fig. 2) of the support 12 or with a counter-coupling means 27, which is supported by the free end of each of the swingable drum swinging arms 31, 31' of the dual drum capstan, as will now be described in more detail.

Before uncoiling a coiled drum 13 it is necessary to turn the drum 180°, so that the coiled cable K is accessible for uncoiling. The turning of the drum 13 takes place by means of the drum swinging arms 31, 31'.

To advantage, the device according to the invention is formed with two drum swinging arms 31 and 31', forming the so called dual drum capstan. There is a drum swinging arm on either side of the support 12. Each drum swinging arm 31, 31' is provided with a driving means 32 to make possible the swinging of the drum swinging arm 31, 31' in the horizontal plane between two positions, an outer position D' or D and an inner position C. One outer position, D', is intended for uncoiling/pulling off of the drum 13 coiled with cable (to the left in Fig. 5) while the other outer position, D, is a position where the drum 13 is empty (shown to the right in Fig. 5) and is ready for insertion to the inner position C. In the inner position C the drum is connected to the support 12 and is ready for coiling of cable K (in accordance with Fig. 2).

The positions D' and D are taken alternately to the left and to the right. For example, the drum swinging arm 31' collects the coiled drum 13 from the inner position C and takes the drum to position D', where uncoiling is initiated. During the uncoiling in position D' the empty drum 13 is passed from position D to the inner position C by means of the drum swinging arm 31 and is secured to the support 12 where coiling of the said drum is initiated. When the last-mentioned drum is fully coiled in position C, the

first-mentioned drum (in position D) has been uncoiled. Now the drums are exchanged again in that the drum swinging arm 31 collects the now fully coiled drum and takes it to position D for uncoiling/pulling off, more or less at the same time as the now empty drum in position D' is taken to the inner position C and is attached to the support 12 to be coiled again.

The coiling functions thus are as follows. During coiling (when the drum 13 is connected to the support 12 as shown in Fig. 2 and the position is C in Fig. 4) the free end of the cable K is attached to the far end of the drum 13. The other end of the cable K is assumed to be fixed in the slot of a stator frame (S according to Fig. 1). Coiling of the cable K should be carried out such that only one layer of cable will be present on the drum 13. For this purpose, the spreader arm 10 is provided with the device 29 moving the gripping arm 14 so that only one layer of cable is coiled onto the drum 13. When coiling is completed, the cable K is lifted off the gripping arm 14. The drum swinging arm 31 (or 31') is driven from its outer position D (or D') by means of its driving means 32 towards the coiled drum in the inner position C. By means of the coupling means 27 the drum swinging arm is connected with the coupling means 16 of the drum 13, and the coupling F of the drum 13 to the support 12 is released. The coiled drum 13 is swung to the outer position D (or D'). In this position the free end of the cable is accessible for uncoiling of the cable from the "leading edge" of the drum for continued winding. Almost at the same time (as soon as the coiled drum has left the support 12 by means of the drum swinging arm), the other drum swinging arm 31' swings the now empty drum towards the support 12 for renewed cable coiling action. When the coupling F of the support 12 has received the empty drum, the connection between the coupling means 27 of the drum swinging arm 31' and the coupling means 16 of the drum 13 is released, whereafter the drum swinging arm 31' returns to the outer position D' (i.e. without drum) while awaiting coiling of the drum once more.

It will be understood that the drum swinging arms 31, 31' thus work alternately, so that on one occasion there is a fully coiled drum in the outer position D and an empty drum in the outer position D', while next time the reverse is the case with a fully coiled drum in the outer position D' and an empty drum in the outer position D.

While the coiling device according to the invention has been described in conjunction with the preferred embodiment illustrated in the drawings it will be obvious to a person skilled in the art that modifications can be made to various parts without departing from the principle of the invention. The invention therefore must not be considered limited to what is shown and described with reference to the drawings but is defined solely by the appended claims.

CLAIMS

1. A device for coiling and uncoiling of elongated goods (K), such as wire, cable or the like, onto a drum (13) and comprising a support (12) with driving means (25) for a spreader arm (10), which is rotatably mounted on the support (12) for coiling and uncoiling the elongated goods (K) onto the stationary drum (13), **characterized** in that the spreader arm (10) at the side thereof facing the goods (K) has a gripping arm (14), which is arranged to guide the elongated goods (K) substantially in a tangential direction relative to the periphery of the drum (13) and that at least one drum swinging arm (31, 31') is connected to the support (12) so as to collect or deliver the drum (13) at the support.
2. A device according to claim 1, **characterized** in that the gripping arm (14) is shaped as a curved V-profile with a running track (20, 21) arranged for the elongated goods (K), which running track is oriented towards the drum (13).
3. A device according to claim 2, **characterized** by feeding rollers (20) which are mounted within the gripping arm (14) so as to form the running track of the V-profile.
4. A device according to claim 3, **characterized** in that the feeding rollers (20) are spherical in shape and present a rolling resistance near zero to eliminate twisting of the elongated goods (K) during coiling and uncoiling.
5. A device according to any of the preceding claims, **characterized** in that the spreader arm (10) is formed with a device (29, 30) for moving the gripping arm (14), so that at least one layer of the elongated goods (K) is coiled onto the drum (13).

6. A device according to claim 5, **characterized** in that the device (29, 30) for moving the gripping arm (14) is comprised of a screw (29) which is driven through the rotation of the spreader arm (10) by means of a belt or chain
5 (30) mounted on the axle (11) fixed on the support (12).

7. A device according to claim 1, **characterized** in that the drum swinging arm (31, 31') is connected to one side of the support (12) and comprises a driving device (32)
10 to make possible swinging between an uncoiling position (D' or D) and a coiling position (C) connected to the support (12).

8. A device according to claim 7, **characterized** in that the swinging arm (31, 31') at one free end is provided with a counter-coupling means (27) for connection with the counter-coupling means (16) provided on the drum (13), the drum (13) being releasable from and attachable to the support (12) by means of the swinging arm (31, 31') in its
20 coiling position facing the support (12).

9. A device according to any of claims 1, 7 or 8, **characterized** in that the support (12) is formed with two drum swinging arms (31, 31'), one on either side of the support, for alternately placing a coiled drum (13) in the
25 uncoiling position (D' and D) of either drum swinging arm and collecting an empty drum (13) in the uncoiling position (D and D' respectively) of either drum swinging arm.

30 10. A device according to any of claims 1 - 9, **characterized** in that the elongated goods is a high-voltage cable.

11. A device according to claim 10, **characterized** in that the high-voltage cable is of a kind comprising a core with a plurality of wires, an inner semiconductive layer
35 surrounding the core, an insulating layer surrounding the inner semiconductive layer and an outer semiconductive layer surrounding the insulating layer.

12. A device according to claim 10 or claim 11, **characterized** in that the high-voltage cable has a diameter ranging from 20 to 200 mm and a conductor area ranging from
5 80 to 3000 mm².

13. A mounting machine comprising a device for coiling and uncoiling according to any of the preceding claims and intended for feeding of cable (K) when mounting the cable in
10 the slots of a stator (S) for an electric machine.

14. An intermediate storage means comprising a device for coiling and uncoiling according to any of claims 1 - 9 and intended for feeding of cable (K) when mounting the
15 cable in the slots of a stator (S) for an electric machine.

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Fig. 1

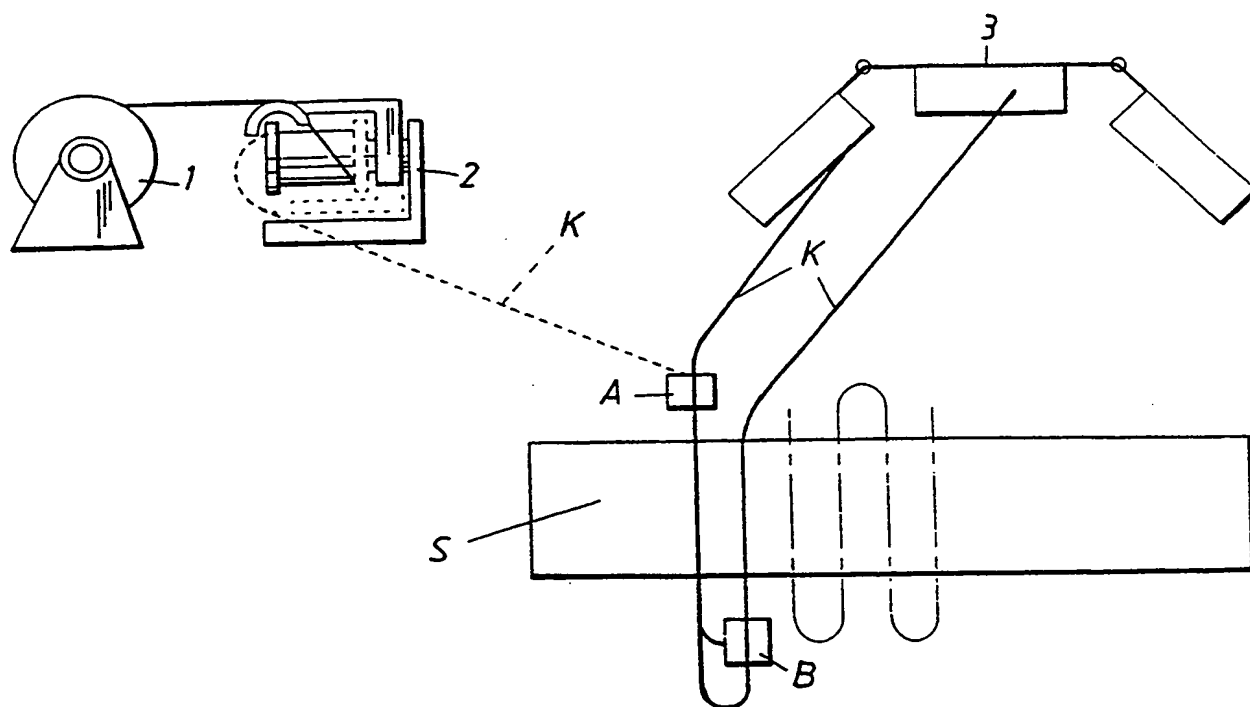
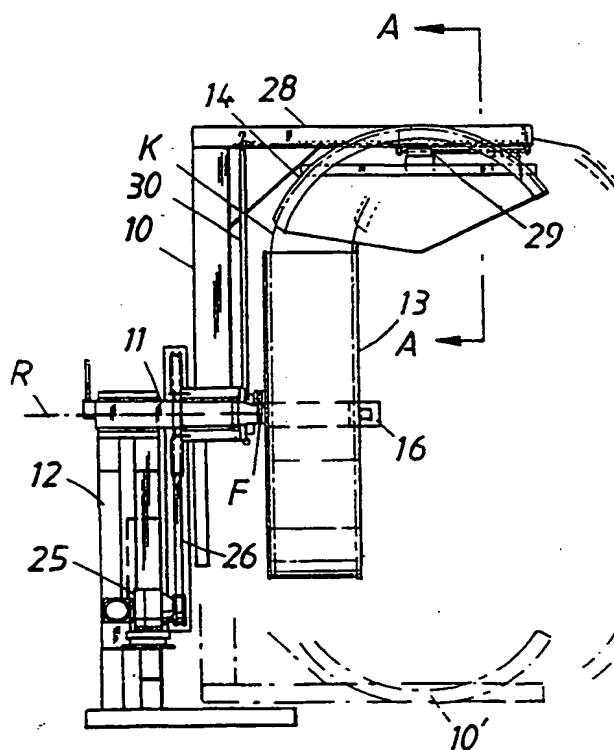


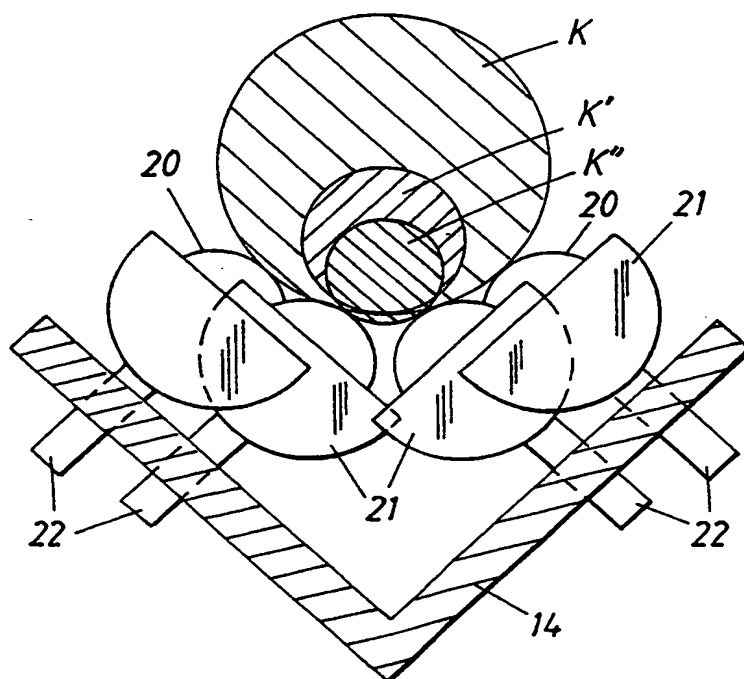
Fig. 2



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Fig. 3

A-A



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Fig. 4

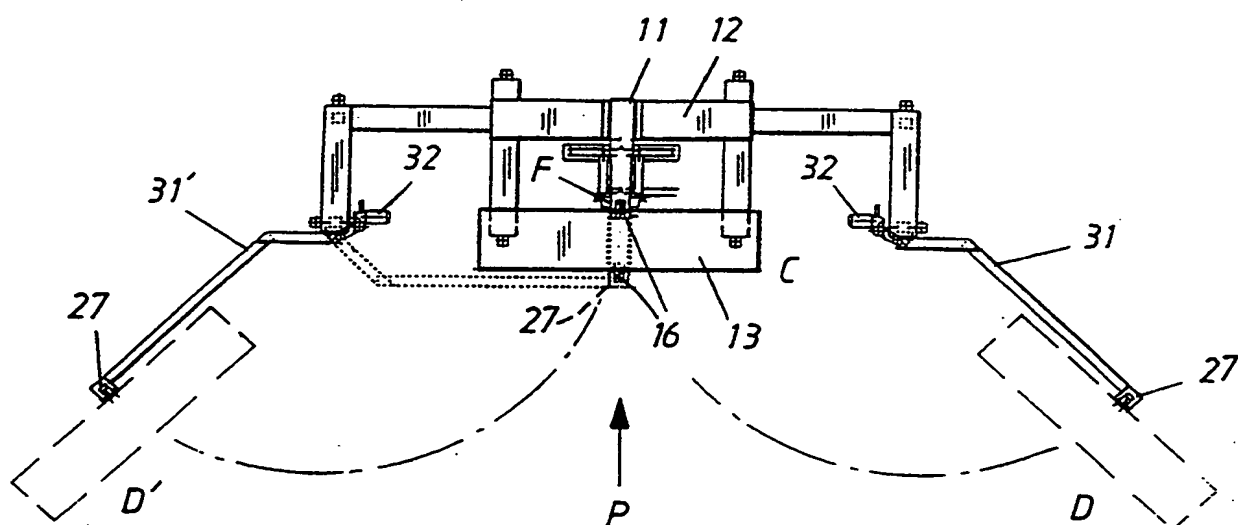
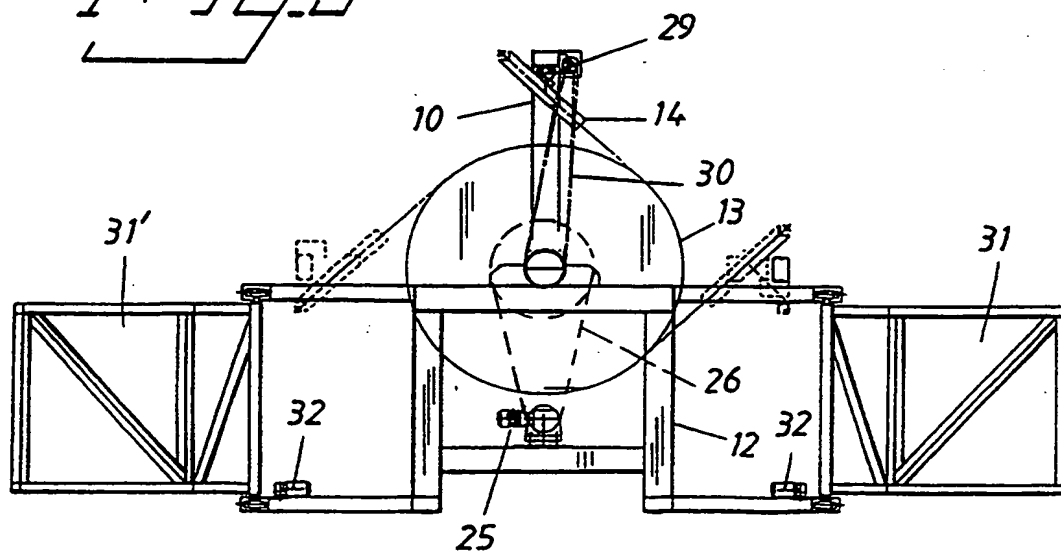


Fig. 5



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 98/00176

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B65H 67/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B65H, H02G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4883230 A (L. LINDSTRÖM), 28 November 1989 (28.11.89)	1-14
	--	
A	EP 0142813 A2 (S.A.M.P. S.P.A.), 29 May 1985 (29.05.85)	1-14
	-- -----	

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INTERNATIONAL SEARCH REPORT
Information on patent family members

02/04/98

International application No.
PCT/SE 98/00176

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4883230 A	28/11/89	DE 3867138 A	06/02/92
		EP 0295230 A,B	14/12/88
		SE 457792 B,C	30/01/89
		SE 8702454 A	13/12/88
<hr/>			
EP 0142813 A2	29/05/85	SE 0142813 T3	
		US 4610404 A	09/09/86
<hr/>			